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Description

This invention relates to tokens and to apparatus for handling tokens.

The invention is particularly but not exclusively concerned with tokens which are generally coin-sized and shaped, and which contain electronic circuitry capable of storing a value which can be read out by an interrogator which communicates with the token in a contactless manner. preferably, the data stored by the token can also be altered by the interrogator. Examples of such a token and of apparatus for interrogating the token are described in GB-A-2075732, GB-A-2153128 and EP-A-147099.

In the interrogators described in the latter two patent specifications, coins and tokens are inserted into a common path leading to a coin validator. The validator is readily capable of ascertaining that an inserted token does not have physical properties corresponding to any of the coins the validator is programmed to validate. Accordingly, the inserted token is caused to be delivered to a reject path. The interrogator is disposed along the reject path so that any tokens and non-genuine coins are received by the interrogator. The interrogator detects the presence of a received token or rejected coin, attempts to interrogate the item and if no response is received (i.e. if the received item is a non-genuine coin rather than a token) the item is delivered to a return chute. If the received item is a token, interrogation takes place before the item is returned to the user via the return chute.

Such an arrangement is very convenient in some installations, particularly when it is desired to convert certain types of existing coin validation apparatus to render them capable of handling tokens.

An alternative arrangement is described in DE-A-3228225, which discloses a coin-shaped token which can be electronically verified within a coin verifier, by making electrical contact with concentric conductive paths. The dimensions and impedance of the token can also be verified. The token would need to be held stationary in the coin verifier while its data is being read, which would substantially decrease the rate at which coins could be verified. Also, the verifier would have to be complicated and non-standard.

According to the present invention there is provided apparatus for handling coins and tokens, the apparatus comprising:

a coin validator having an entry path arranged to receive acceptable coins, data-storing tokens and non-acceptable items, and means for discriminating between acceptable coins and non-acceptable items;

separating means responsive to the discriminating means for separating the non-acceptable items from the acceptable coins;

and a token test station operable to receive a token delivered along a path from the validator and at which data is read out of the token by a token testing means;

characterised in that the discriminating means is additionally able to recognise data-storing tokens and to cause the separating means to direct the tokens along said path, which path is different from a path along which said non-acceptable items are directed.

The tokens may be directed along the same path as at least one acceptable coin denomination. The path may lead to a gate, desirably an escrow gate, from which the coins and tokens can be selectively directed either to a store (such as a cashbox) or to a return chute for return to the user.

Preferably the discriminating means is operable to measure a property of received items, to recognise a received item as a coin of a particular denomination in dependence upon whether a measured property lies within a range associated with that denomination, and to recognise a received item as a token in dependence upon whether a measured property lies within a further range associated with the token. In the preferred embodiment, the validator stores a particular parameter range for a coin denomination, and recognises an inserted item as that coin denomination if the measured property lies within that range. Preferably the validator stores ranges associated with different properties, and recognises the coin only if all of a plurality of measured properties fall within the respective parameter ranges. Other ranges are preferably stored to enable detection of other coin denominations. In addition, the validator stores a range specifically associated with the tokens (or a plurality of ranges each associated with a different measured property of the tokens). Accordingly, a data-storing token can be recognised just as though it were a different denomination of coin.

Preferably, means are provided for initiating the operation of the token test station in response to the validator detecting that a received item is a token.

Preferably, the apparatus has means for selectively directing items (which may be coins or tokens) at the test station either to a first path or a second path, the first path preferably being arranged to return the items to a user and the second path preferably being arranged to direct the items to a store where they are retained. The selective directing means may be an escrow gate which is operated during or after a transaction.

The invention also extends to a combination of such apparatus with a token suitable for use in the apparatus. The tokens preferably incorporate electronic circuitry, preferably store data in an alterable manner, can preferably be interrogated in a contactless manner and preferably have physical properties such that they can be recognised by a coin validator.

Embodiments of the invention preferably combine some, and more preferably all, of the above aspects.

A specific embodiment to be described below has a coin validator arranged to receive both coins and electronic tokens, and is operable to

measure physical properties of received items to determine whether an item is one of several denominations of coins or an electronic token. If an item is none of these, it is delivered to a reject path whereby it is returned to the user. If an item is a token it is delivered to an interrogator located in proximity to a gate at which the token is halted while it is interrogated. The gate preferably also serves as an escrow gate, whereby the token is retained until a transaction is completed, or possibly until the token value has been expended, whereupon the value stored by the token is updated in accordance with the value expended as a result of the transaction, and the token is then delivered to a refund chute for return to the user. Preferably, if the updated value of the token is zero the token is instead delivered to a store or cashbox.

In a preferred embodiment, coins of one or more specific denominations are also delivered to the same escrow gate, from which they can be either sent to the cashbox or returned to the user as is known per se in prior art escrow gate arrangements.

Other denominations of coins can be delivered to one or more other paths, each of which may contain a respective escrow gate.

Such an arrangement gives rise to a number of advantages. The rate at which the apparatus is capable of rejecting items which are neither genuine coins nor tokens is substantially increased compared with the arrangement described in GB-A-2153128, because the coin validator segregates the rejected items which therefore no longer have to be checked by the token interrogator.

It is known to arrange coin validators so that power consumption is reduced by powering up certain parts of the circuitry only when the arrival of a coin has been sensed.

Reference is made to GB-A-2093620 and GB-A-2143982, which disclose a coin validator having means responsive to insertion of a coin for bringing different sections of the circuitry up to full power independently during the periods when their operation is required. Such an arrangement could also be used in apparatus according to the present invention, in which case an arrival sensor would operate to power up the appropriate parts of the validator following arrival of both tokens and coins. In addition, in order to further save current consumption, the interrogator is preferably powered only when needed. This could be achieved in a different manner from the techniques disclosed in GB-A-2093620 and GB-A-2143982, by arranging for the token testing station as a whole to be powered up in response to detecting that an inserted item (i.e. a token) has properties falling within specific ranges. There would be no need for an additional, permanently powered arrival sensor to detect arrival of items at the interrogator. The above embodiment contrasts with the arrangement of GB-A-2153128 by avoiding the need for powering up the interrogator every time a non-genuine coin is inserted.

A further important advantage of the arrange-

ment set out above is that the electronic token is subject both to property measurement by the validator and interrogation by the interrogator, so that it becomes very difficult to construct fraudulently an item which would be accepted by the apparatus as a genuine token.

Another advantage of the arrangement mentioned above is that the structure becomes very compact, particularly if the same escrow gate is used both for coins and tokens. Such an arrangement also renders simple the modification of existing structures incorporating escrow gates to allow them to handle tokens.

Contemporary validators are generally very good at discriminating between genuine and non-genuine coins. It will therefore be appreciated that any electronic data storing token would not be recognisable to a conventional validator. Indeed, the physical properties of an electronic token would be likely to be so different from the properties of a genuine coin that the arrival sensor mentioned above would not be operated by the arrival of the token, and consequently the coin validator would not be powered up so that it would not even "see" the token.

It is very desirable that some of the physical properties of a token according to the present invention be relatively close to those of genuine coins. Otherwise, conventional validator circuits would have to be adapted to enable recognition of the tokens. In addition, a validator which was required to recognise tokens having widely different properties from coins would have to operate over such a large bandwidth that its discrimination of genuine coins would be deteriorated.

Thus, the token preferably incorporates a conductive member for rendering the token recognisable to a coin validator. The member is preferably centrally disposed in the token and may for example be generally cylindrical.

The conductive member is preferably non-magnetic, and may be made of metal, such as copper or brass, or ferrite. There is preferably a printed circuit board carrying at least some of the circuit components of the token, the board being disposed around the conductive member.

In a preferred embodiment, the conductive member extends right through the thickness of the token. Preferably the member itself and the token are concentric. The member could be a slug or pellet, or alternatively could be formed by a rivet.

The presence of the conductive member renders the token detectable by the coin validator. By disposing the conductive member in the middle of the token and concentric therewith, the physical properties detected by the validator are substantially constant irrespective of the orientation of the token. In addition, as explained further below, the token can be arranged so that those physical properties individually detected by respective coin sensors may correspond to or at least approach the properties of genuine coins, but may when taken together be very easily distinguishable from the combinations of properties found for genuine coins so that there is

no danger of confusion between them.

In the above-described arrangement, the tests performed by the coin validator to validate coins are sufficient also to recognise the presence of tokens. In an alternative arrangement, separate tests are carried out to detect tokens and to validate coins. The validator may have a separate sensor which is used solely for detecting tokens. This may for example be an inductive sensor. Preferably the token incorporates a tuned circuit, and the inductive sensor is driven at a frequency substantially equal to that of the tuned circuit. Accordingly, when the token passes a sensor a significant alteration in the sensor output is caused.

The token preferably has a coil arranged to act as an antenna during interrogation, as in the arrangement described in GB-A-2153128, and preferably the token is arranged so that both data and power are received from the interrogator by means of the antenna.

The antenna coil may be used in place of the conductive member referred to above, for making the token recognisable to the coin-validating sensing circuitry of the coin validator. In the alternative arrangement described above in which the token incorporates a tuned circuit for detection by a separate sensor, the antenna coil may form part of this tuned circuit.

An arrangement embodying the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a block diagram of apparatus in accordance with the invention for handling both coins and electronic data-storing tokens;

Figure 2 is a plan view of a token which can be handled by the apparatus of Figure 1; and

Figure 3 is a section through the token of Figure 2, showing the token within a coin path of the apparatus of Figure 1.

Referring to Figure 1, the apparatus 2 comprises a coin validator 4 which may for example be of the type described in GB-A-2093620. The apparatus also includes a token interrogator 6 which is substantially identical to that of the embodiment of Figures 5 to 8 in GB-A-2153128.

The present invention is of particular value when applied to pay-phones. The apparatus of the present embodiment is used in a pay-phone, and incorporates a pay-phone controller 8. The controller 8 is arranged to permit use of a telephone (not shown) when a user has inserted a coin or a token storing a credit value. Except insofar as is described below, the controller 8 operates in substantially the same way as controllers in existing pay-phones which operate upon insertion of coins or magnetically encoded debit cards.

Coins and tokens are inserted into the apparatus via a common path 10. When an item is inserted, it is delivered first to the validator 4. Assuming that the item is conductive and has appropriate physical parameters, its presence is sensed by an arrival/thickness sensor S1 and appropriate circuitry within the validator 4 is

powered up. In particular, a further two testing stations, incorporating material and diameter sensors S2 and S3, are actuated, so that in all three tests are performed on the item. Accordingly, three measured property values are obtained.

The validator 4 has a memory storing six sets of parameters. Each set consists of three ranges, each of which is defined by upper and lower limit values stored in the memory. The first five sets are associated with the U.K. coin denominations 5p, 10p, 20p, 50p and £1. The sixth set is associated with the token that is intended to be handled by the apparatus.

The validator 4 checks the measured properties against the ranges within each set. If all three measured properties fall within the three respective ranges of one particular set, the item is accepted as being either a token or one of the five coin denominations, depending upon which set contains the three ranges within which the properties fall.

Instead of storing the upper and lower limit values for each range, other techniques are possible. For example, the memory could store a single value, the validator having circuitry for calculating the upper and lower limits from that value using either a predetermined or stored tolerance value.

The validator has a number of output lines indicated at 12 for carrying signals to indicate that an inserted item has been accepted, and also to indicate which set of ranges contain all the measured properties (i.e. whether or not the item was a token, and if not what the denomination of the accepted coin was).

The controller 8 responds to the signal by selectively actuating a plurality of solenoids indicated at 14.

If the inserted item was not found acceptable, no solenoids are operated and the item falls straight through to a reject path 15, whereupon the item is returned to the user via a refund chute 16.

If the inserted item was accepted and found to be a 5p, 10p or 20p coin, the solenoids 14 are so actuated as to cause the item to be delivered along a path 17 to an escrow gate indicated at 18.

If the inserted item was either a 50p coin, a £1 coin or a token, the solenoids 14 are so actuated as to deliver the item to a path 20 leading to an escrow gate 22. Items arriving at the escrow gate 22 can be interrogated using a pair of inductive coils indicated schematically at 24, the coils being connected to the Interrogator circuitry 6.

The escrow gates 18 and 22 can be operated in a known manner to release an item held thereby into either the refund chute 16, where the item is returned to the user, or a cashbox 26. This is carried out under the control of the pay-phone controller 8 linked to the escrow gates via control lines indicated at 28.

The apparatus acts as a standard payphone used in coin-operated telephones except when a token is inserted. As coins are inserted, the

payphone controller accumulates a credit count representing the total value of the coins inserted, and the coins are delivered to the appropriate escrow gate so that in some circumstances a plurality of coins may be stacked in turn at each escrow gate. The controller also preferably stores information indicating what items are held by the escrow gates and the sequences in which they are arranged. The controller allows use of the telephone and calculates the cost of the telephone call. The call is of course terminated if the cost reaches the accumulated credit. Otherwise, at the end of the call, the cost is deducted from the credit and if sufficient remains appropriate coins are returned to the user from one or both of the escrow gates after the other coins have been delivered to the cashbox 26.

If a token is inserted, either alone or in addition to a number of coins, the credit value is not incremented until the token has reached the escrow gate 22, has been interrogated and found to be valid and has further been found to have stored therein a token credit value. In these circumstances the token credit value is added to the credit stored in the payphone controller, whereas the value in the token itself is cleared.

At the end of the call, if any credit remains it is written into the token using the interrogator, and the token is refunded to the user. Otherwise, the token is delivered to the cashbox.

Assuming that the apparatus is designed so that one or more coins can be inserted and accepted in addition to a token, the arrangement is preferably such that the amount of credit written into the token at the end of the call never exceeds the amount read out therefrom. This can be facilitated by so controlling the escrow gates that as much as possible of the cost of the call is paid for by the inserted coins, rather than the credit value stored in the token.

In an alternative arrangement, the escrow gates are selectively actuated during the telephone call so as to pay for the call, so that the controller need not calculate the total value of the inserted coins. Thus, if a coin or token is present adjacent either of the escrow gates 18 and 22, the payphone controller 8 permits use of the telephone for a period for which the cost corresponds to the largest denomination coin adjacent an escrow gate (or corresponding to the credit in the token if a token is adjacent the escrow gate 22). At the end of that period, the largest denomination coin, or token, as appropriate, is then sent to the cashbox 26. The operation then continues until the call is terminated by the user or until there is no coin or token present at either of the escrow gates.

In payphones, power consumption is very important. The validator 4 and interrogator 6 together consume a large amount of power relative to that available. The present embodiment is arranged so that at no time are the validator and interrogator both in operation.

When a token has been received by the validator, the payphone controller is operable to power up the interrogator by delivering thereto a

signal on one of a plurality of lines 30. The signal is delayed slightly so as to allow time for the power to the validator to switch off following the validation operation. If desired, the payphone controller could be arranged to inhibit any powering up of the validator, and thereby inhibit acceptance of any coins, during the time that the interrogator is switched on.

The present embodiment is arranged so that both coins and tokens can be delivered to the escrow gate 22. Accordingly, if a token is sent to the escrow gate 22 after a coin has already been sent there, the token will be stacked behind the coin and therefore will not be adjacent the interrogator coils 24. It would therefore not be appropriate to power up the interrogator at this time. To deal with this, the controller 8 may use its stored information concerning the items which have been sent to the escrow gate 22. Each time an item is released from the escrow gate 22, the controller 8 checks the stored information to determine whether the next item is one which the validator has determined to be a token. If so, the interrogator 6 is powered up.

Alternatively, the interrogator 6 can be arranged to be powered up each time a new item arrives at the interrogator coils 24. A correct response will be received only if the item is a valid token.

The controller 8 may alternatively be arranged such that during the course of a single use of the apparatus only coins are delivered, or only a token is delivered, to the escrow gate 22, so that there is never a mixture of coins and tokens sent thereto. Indeed, the apparatus could be arranged so that during a single transaction it is not possible to use both coins and tokens. Accordingly, if the first accepted item is a coin, subsequently inserted tokens are not accepted. Correspondingly if the first item is a token, subsequently inserted coins are not accepted.

Referring to Figures 2 and 3, the token is indicated generally at 100. The token is generally disc-shaped and includes an annular double-sided printed circuit support or film 102, e.g. of P.V.C., fibreglass or Kynvar (Registered Trade Mark) having thereon a printed circuit on which is surface mounted a number of components indicated generally at 104. The circuit is coupled to an antenna coil indicated at 108 which encircles the printed circuit support and which has an inner diameter greater than the outer diameter of the support 102. A cylindrical, brass pellet 109 is disposed at the centre of the token 100 and concentrically therewith, within the inner periphery of the printed circuit support 102. The pellet 109 forms a conductive member which is used to render the token recognisable to the validator.

The printed circuit support 102, circuit components 104, antenna coil 108 and pellet 109 are encapsulated in a plastics housing indicated at 110. The housing is disc-shaped and has a diameter of from 20 to 30 mm and an overall thickness including rims indicated at 111 of from

2.0 to 3.0 mm. The pellet 109 has a diameter of from 4 to 6 mm, preferably substantially 5 mm, and a length of preferably 1.8 to 2.8 mm, more preferably substantially 2.5 mm, which length is preferably equal to the thickness of the body of the token in its central region so that the ends of the pellet 109 are flush with the central regions of the token housing.

The first testing station of the coin validator 4, incorporating the sensor S1, is shown in Figure 3. The sensor S1 is formed of a pair of inductance coils indicated schematically at 112 and 114 and located on opposite sides of the coin path. As shown, the path is slightly canted so that the coins and tokens roll along one side wall thereof, in closer proximity to one of the coils 112 than to the other 114. This is to ensure substantially reliable positioning of the coins and tokens so as to get consistent test results. Because the pellet 109 is symmetrical about the axis of the housing, the actual position of the housing around its axis as it passes the coils does not alter the effect of the pellet on the coils.

Those properties of the token 100 which are detected by the thickness sensor S1 correspond approximately to the properties which would be detected if a thin copper coin were to be inserted. This is because the pellet, although quite thick, is spaced by the token rim from the side wall of the coin path and is of small diameter and located well within the areas of the coils 112 and 114, so that it would not have as great an effect as a conductive disc of the same thickness whose diameter was such that, as it rolled along the ramp, it covered a large area of the coils. In addition, because the surface area of the pellet is small, it will produce a small diameter reading from the diameter sensor. The consequence of this is that a conductive disc which would produce from the diameter sensor a reading corresponding to that of the token would necessarily have a small diameter and therefore would pass below the thickness sensor and thus not produce a reading from the thickness sensor. Thus, the pellet enables recognition by the validator of the token, but avoids the possibility of confusion with genuine coins.

Instead of the pellet 109 illustrated, a rivet could be used. This would have a relatively thin shank passing through a small-diameter hole in the printed circuit support 102, and relatively large-diameter heads for retaining the rivet in position.

The use of a pellet or rivet has the added advantages of increasing the weight of the token so that it approaches that of the lighter forms of genuine coins, and of not substantially interfering with the coupling between the antennas of the token and interrogator.

The pellet 109 may be omitted if the remainder of the token is arranged so as to produce sufficient readings from one or more of the sensors S1, S2 and S3. For example, the antenna coil 108 may be designed to produce adequate sensor readings.

Alternatively, a separate sensor, which is not

used for coin validation, may be provided specifically for detecting tokens. Preferably this is an inductive sensor coupled to an oscillator operating at a frequency substantially equal to the resonant frequency of a tuned circuit in the token 100, such tuned circuit preferably including the antenna coil 108. The sensor may be positioned at any location between the entry and exit of the coin validator 4, either before, after or between the sensor coils S1, S2 and S3.

Claims

1. Apparatus for handling coins and tokens, the apparatus comprising:

15 a coin validator (4) having an entry path (10) arranged to receive acceptable coins, data-storing tokens and non-acceptable items, and means (S1, S2, S3) for discriminating between acceptable coins and non-acceptable items;

20 separating means (14) responsive to the discriminating means (S1, S2, S3) for separating the non-acceptable items from the acceptable coins;

25 and a token test station operable to receive a token delivered along a path (20) from the validator (4) and at which data is read out of the token by a token testing means (6, 24);

30 characterised in that the discriminating means (S1, S2, S3) is additionally able to recognise data storing tokens and to cause the separating means (14) to direct the tokens along said path (20), which path (20) is different from a path (15) along which said non-acceptable items are directed.

35 2. Apparatus as claimed in claim 1, the separating means (14) being arranged to direct coins of at least one denomination along the path (20) leading to the token test station.

40 3. Apparatus as claimed in claim 1 or 2, the separating means (14) being arranged to direct coins of at least one denomination along a further path (17).

45 4. Apparatus as claimed in any preceding claim including means (22) for selectively directing items at the test station to a return path (16) for return to the user or to a store (26) for retention therein.

50 5. Apparatus as claimed in claim 4, wherein the selective directing means (22) is an escrow gate arranged to be operated after a transaction.

55 6. Apparatus as claimed in claim 4 or claim 5, including means (6, 24) for writing data into a token before the token is directed to said return path (16).

7. Apparatus as claimed in any preceding claim, including means (8) for initiating an operation of said token testing means (6, 24) in response to a signal from the validator (4) indicating receipt of a token.

60 8. Apparatus as claimed in claim 7, wherein said initiating means (8) causes powering-up of the token testing means (6, 24).

9. Apparatus as claimed in claim 8, arranged such that the validator (4) is not powered while the token testing means (6, 24) is powered.

65 10. Apparatus as claimed in any one of claims 1

to 6, including means responsive to the arrival of a token at the test station for initiating operation of the token testing means (6, 24).

11. Apparatus as claimed in any preceding claim, wherein the discriminating means (S1, S2, S3) is arranged to determine whether a measured property of a received item falls within a coin parameter range to determine whether the item is an acceptable coin, and whether the measured property falls within a token parameter range to determine whether the item is a token.

12. A combination of apparatus (2) as claimed in claim 11 and a data-storing token (100) for use therewith, the token (100) being recognisable by the discriminating means of the apparatus (2).

13. A combination as claimed in claim 12, the token (100) including a conductive member (109) detectable by an inductive sensor (112, 114) of the discriminating means (S1, S2, S3).

14. A combination as claimed in claim 13, wherein the conductive member (109) is disposed symmetrically with respect to the axis of a housing (110) of the token (100).

15. A combination as claimed in claim 13 or claim 14, wherein the conductive member (109) is a substantially cylindrical pellet.

16. A combination as claimed in claim 13 or claim 14 wherein the conductive member comprises a rivet.

17. Apparatus as claimed in any one of claims 1 to 10, wherein the discriminating means comprises first sensing means for discriminating between acceptable coins and non-acceptable items, and second sensing means for detecting data-storing tokens.

18. Apparatus as claimed in claim 17, wherein the second sensing means comprises an inductance forming part of an oscillator which oscillates at a frequency substantially equal to the resonant frequency of a tuned circuit in the token.

Patentansprüche

1. Gerät zur Verarbeitung von Münzen und Wertmarken, umfassend einen Münzen-Gültigkeitsprüfer (4) mit einer Einlaufbahn (10), die zum Empfang von annehmbaren Münzen, Datenspeicher-Wertmarken und nicht-annehmbaren Gegenständen ausgelegt ist, und einer Einrichtung (S1, S2, S3) zur Unterscheidung zwischen annehmbaren Münzen und nicht-annehmbaren Gegenständen,

eine auf die Unterscheidungseinrichtung (S1, S2, S3) ansprechende Trenneinrichtung (14) zum Trennen von nicht-annehmbaren Gegenständen von annehmbaren Münzen, und

eine Wertmarken-Prüfstation, die so betätigbar ist, daß sie eine längs einer Bahn (20) von dem Gültigkeitsprüfer (4) zugeführte Wertmarke empfängt, und an der durch eine Wertmarken-Prüfeinrichtung (6, 24) Daten aus der Wertmarke ausgesehen werden,

dadurch gekennzeichnet, daß die Unterscheidungseinrichtung (S1, S2, S3) zusätzlich in der Lage ist, Datenspeicher-Wertmarken zu erkennen

und zu bewirken, daß die Trenneinrichtung (14) die Wertmarken längs der besagten Bahn (20) leitet, wobei diese Bahn (20) von einer Bahn (15), längs der nichtannehmbaren Gegenstände geleitet werden, verschieden ist.

2. Gerät nach Anspruch 1, wobei die Trenneinrichtung (14) so ausgelegt ist, daß sie Münzen mindestens eines Nennwertes längs der zu der Wertmarken-Prüfstation führenden Bahn (20) leitet.

3. Gerät nach Anspruch 1 oder 2, wobei die Trenneinrichtung (14) so ausgelegt ist, daß sie Münzen mindestens eines Nennwertes längs einer weiteren Bahn (17) leitet.

4. Gerät nach einem der vorhergehenden Ansprüche, mit einer Einrichtung (22), die Gegenstände an der Prüfstation selektiv einer Rückgabebahn (16) zur Rückgabe an den Benutzer oder einem Speicher (26) zum Verbleib in diesem zuleitet.

5. Gerät nach Anspruch 4, wobei die selektive Leiteinrichtung (22) ein Hinterlegungsgatter ist, das nach einer Transaktion betätigbar ist.

6. Gerät nach Anspruch 4 oder 5, mit einer Einrichtung (6, 24) zum Einschreiben von Daten in eine Wertmarke, bevor diese der Rückgabebahn (16) zugeleitet wird.

7. Gerät nach einem der vorhergehenden Ansprüche, mit einer Einrichtung (8) zur Initiierung eines Betriebs der Wertmarken-Prüfeinrichtung (6, 24) bei Auftreten eines den Empfang einer Wertmarke anzeigen den Signals von dem Gültigkeitsprüfer (4).

8. Gerät nach Anspruch 7, wobei die Initiierungseinrichtung (8) die Beaufschlagung der Wertmarken-Prüfeinrichtung (6, 24) mit Energie bewirkt.

9. Gerät nach Anspruch 8, das so ausgelegt ist, daß dann, wenn die Wertmarken-Prüfeinrichtung (6, 24) mit Energie beaufschlagt ist, der Gültigkeitsprüfer (4) nicht mit Energie beaufschlagt ist.

10. Gerät nach einem der Ansprüche 1 bis 6, mit einer auf die Ankunft einer Wertmarke an der Prüfstation ansprechenden Einrichtung zur Initiierung des Betriebs der Wertmarken-Prüfeinrichtung (6, 24).

11. Gerät nach einem der vorhergehenden Ansprüche, wobei die Diskriminiereinrichtung (S1, S2, S3) so ausgelegt ist, daß sie ermittelt, ob eine gemessene Eigenschaft des empfangenen Gegenstands in einen Münzen-Parameterbereich fällt, um zu bestimmen, ob der Gegenstand eine annehmbare Münze ist, und ob die gemessene Eigenschaft in einen Wertmarken-Parameterbereich fällt, um zu bestimmen, ob der Gegenstand eine Wertmarke ist.

12. Kombination aus einem Gerät (2) nach Anspruch 11 und einer datenspeichernden Wertmarke (100) zur Verwendung mit dem Gerät, wobei die Wertmarke (100) durch die Unterscheidungseinrichtung des Gerätes (2) erkennbar ist.

13. Kombination nach Anspruch 12, wobei die Wertmarke (100) ein von einem induktiven Meßfühler (112, 114) der Unterscheidungseinrichtung (S1, S2, S3) erfaßbares leitfähiges Element (109) enthält.

14. Kombination nach Anspruch 13, wobei das leitfähige Element (109) symmetrisch zur Achse eines Gehäuses (110) der Wertmarke (100) angeordnet ist.

15. Kombination nach Anspruch 13 oder 14, wobei das leitfähige Element (109) ein im wesentlichen zylindrisches Plättchen ist.

16. Kombination nach Anspruch 13 oder 14, wobei das leitfähige Element eine Niete umfaßt.

17. Gerät nach einem der Ansprüche 1 bis 10, wobei die Unterscheidungseinrichtung eine erste Meßeinrichtung zum Unterscheiden zwischen annehmbaren und nicht-annehmbaren Gegenständen und eine zweite Meßeinrichtung zum Erfassen von datenspeichernden Wertmarken umfaßt.

18. Gerät nach Anspruch 17, wobei die zweite Meßeinrichtung einen induktanzbildenden Teil eines Oszillators umfaßt, der auf einer mit der Resonanzfrequenz eines abgestimmten Kreises in der Wertmarke im wesentlichen gleichen Frequenz oszilliert.

Revendications

1. Appareil de manipulation de pièces de monnaie et de jetons, ledit appareil comprenant:

un dispositif (4) de validation des pièces, possédant un chemin d'entrée (10) disposé pour recevoir des pièces acceptables, des jetons porteur d'informations et des articles non acceptables, et des moyens (S1, S2, S3) pour faire la discrimination entre des pièces acceptables et des articles non acceptables;

des moyens de séparation (14) sensible aux moyens de discrimination (S1, S2, S3) pour séparer les articles non acceptables des pièces acceptables;

et un poste de test des jetons destiné à recevoir un jeton délivré le long d'un chemin (20) à partir du dispositif de validation (4), et où les informations contenues dans le jeton sont lues par un moyen (6, 24) de test des jetons; caractérisé en ce que le moyen de discrimination (S1, S2, S3) est de plus capable de reconnaître des jetons porteurs d'information et d'amener les moyens de séparation (14) à diriger les jetons le longdudit trajet (20), lequel trajet (20) est différent d'un trajet (15) le long duquel sont dirigés les articles non acceptables.

2. Appareil selon la revendication 1, le moyen de séparation (14) étant agencé pour diriger des pièces d'au moins une valeur le long du trajet (20) conduisant au poste de test des jetons.

3. Appareil selon la revendication 1 ou 2, le moyen de séparation (14) étant agencé pour diriger les pièces d'au moins une valeur le long d'un autre chemin (17).

4. Appareil selon l'une quelconque des revendications précédentes, comprenant un moyen (22) pour diriger sélectivement des articles au poste de test vers un trajet de retour (16) pour les rendre à l'utilisateur, ou à un magasin (26) pour les conserver.

5. Appareil selon la revendication 4, dans lequel

le moyen directeur sélectif (22) est une porte à dépôt agencée pour être actionnée après une transaction.

5 6. Appareil selon la revendication 4 ou 5, comprenant un moyen (6, 24) pour écrire des informations sur un jeton, avant que le jeton soit dirigé vers le trajet de retour (16).

10 7. Appareil selon l'une quelconque des revendications précédentes, comprenant un moyen (8) pour amorcer un fonctionnement du moyen (6, 24) de test des jetons en réponse à un signal provenant du dispositif de validation (4) indiquant la réception d'un jeton.

15 8. Appareil selon la revendication 7, dans lequel le moyen d'amorçage (8) entraîne l'alimentation du moyen (6, 24) de test des jetons.

20 9. Appareil selon la revendication 8, agencé de telle façon que le dispositif de validation (4) n'est pas alimenté pendant que le moyen (6, 24) de test des jetons est alimenté.

25 10. Appareil selon l'une quelconque des revendications 1 à 6, comprenant un moyen sensible à l'arrivée d'un jeton au poste de test des jetons, pour amorcer le fonctionnement du moyen (6, 24) de test des jetons.

30 11. Appareil selon l'une quelconque des revendications précédentes, dans lequel le moyen de discrimination (S1, S2, S3) est agencé pour déterminer si une propriété mesurée d'un article reçu tombe dans un intervalle de paramètres pour une pièce, pour déterminer si l'article est une pièce acceptable, et si la propriété mesurée tombe dans un intervalle de paramètres pour un jeton, pour déterminer si l'article est un jeton.

35 12. Combinaison d'un appareil (2) selon la revendication 11, et d'un jeton (100) porteur d'information à utiliser avec lui, le jeton (100) pouvant être reconnu par le moyen de discrimination de l'appareil (2).

40 13. Combinaison selon la revendication 12, le jeton (100) comprenant un élément conducteur (109) décelable par undétecteur inductif (112, 114) du moyen de discrimination (S1, S2, S3).

45 14. Combinaison selon la revendication 13, dans laquelle l'élément conducteur (109) est disposé symétriquement par rapport à l'axe d'un logement (110) du jeton (100).

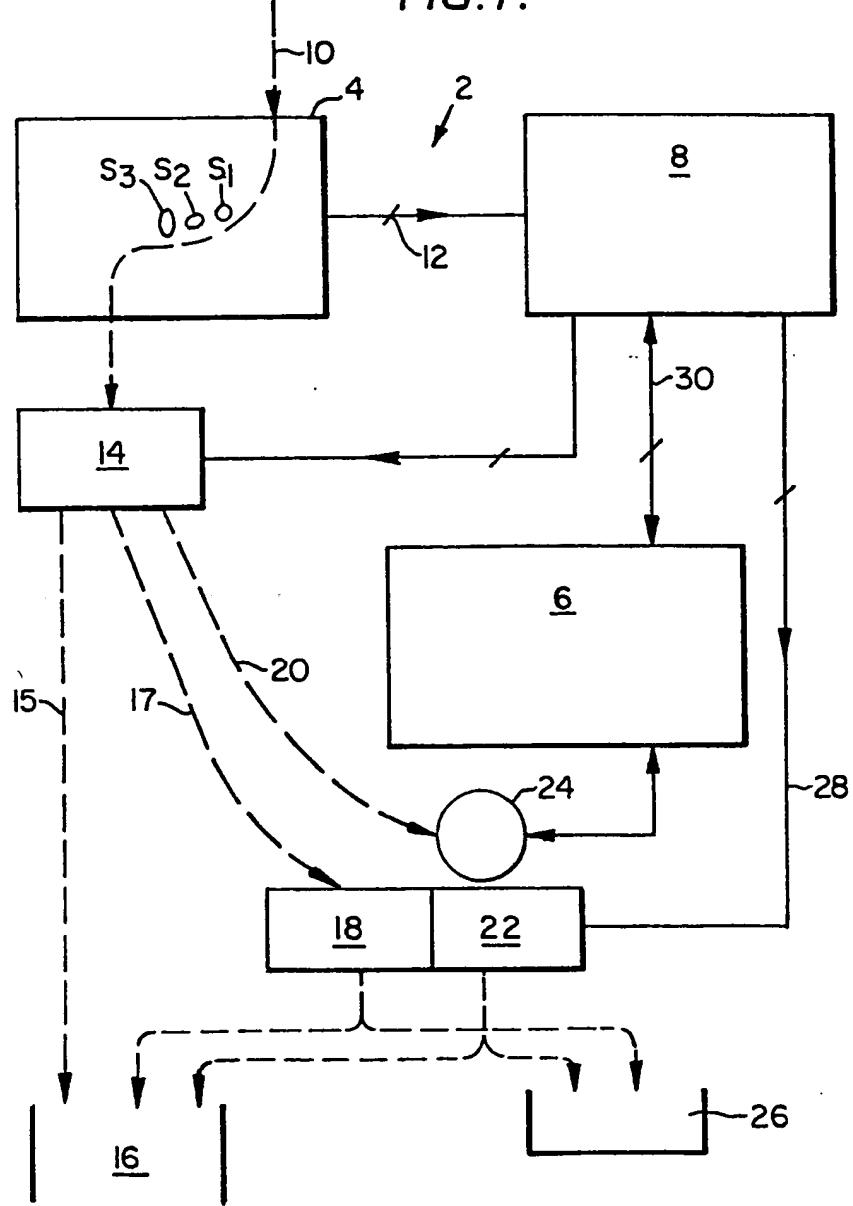
50 15. Combinaison selon la revendication 13 ou 14, dans laquelle l'élément conducteur (109) est une pastille essentiellement cylindrique.

16. Combinaison selon la revendication 13 ou la revendication 14, dans laquelle l'élément conducteur comprend un rivet.

55 17. Appareil selon l'une quelconque des revendications 1 à 10, dans lequel le moyen de discrimination comprend un premier moyen sensible, pour effectuer une discrimination entre des pièces acceptables et des articles non acceptables, et un second moyen sensible pour déceler des jetons porteurs d'information.

60 18. Appareil selon la revendication 17, dans lequel le second moyen sensible comprend une inductance faisant partie d'un oscillateur qui oscille à une fréquence essentiellement égale à la fréquence de résonnance d'un circuit accordé du jeton.

FIG. 1.



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FIG. 2.

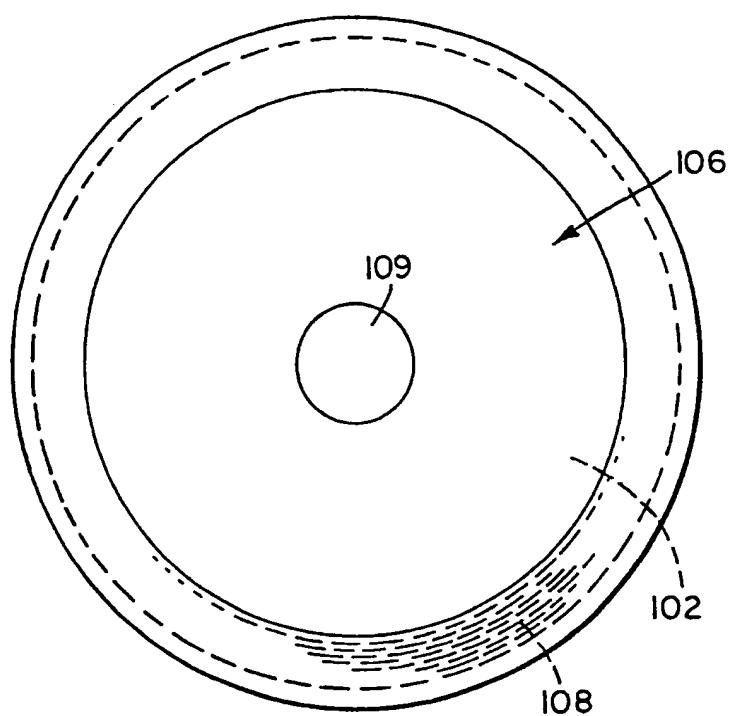
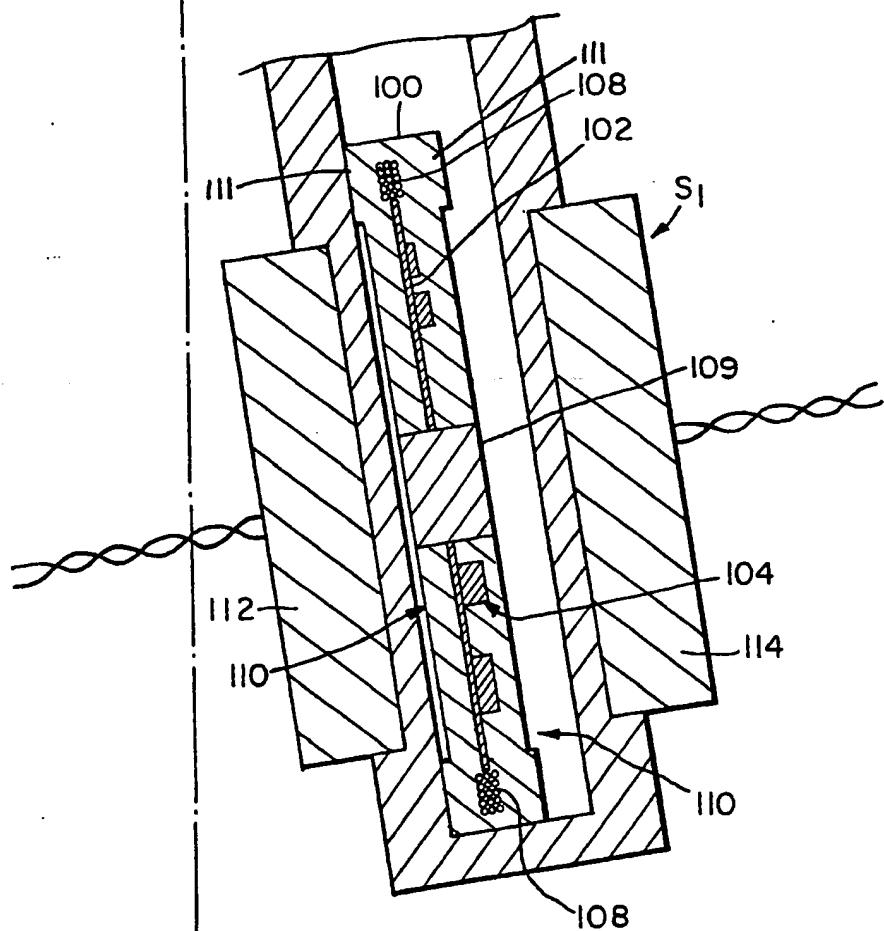


FIG.3.





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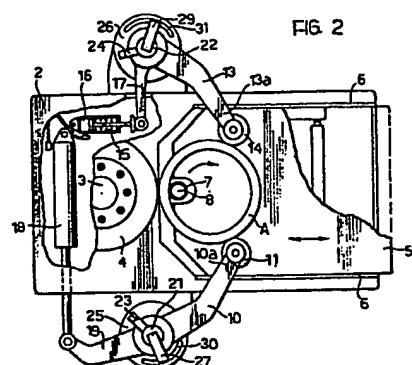
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54 A ring rolling mill.

(57) A ring rolling mill comprising a driven working roll (4) a rotary mandrel (7) serving as a counter-roll, and a containment roller (11) carried by a pivoted arm (10) and able to engage laterally the ring (A) being rolled, further includes a tracer roller (14) carried by a respective pivoted arm (13). The assembly formed by the tracer roller (14) and its respective arm (13) is a mirror image of the assembly formed by the containment roller (11) and its respective arm (10) across the vertical plane identified by the axes of rotation of the working roll (4) and of the mandrel (7), which are both vertically orientated. Means (21, 22) for detecting the angular position of the tracer arm (13) and of the containment arm (10) are connected to an electrical control circuit (32) of an hydraulic servo valve (34) for regulation and locking of the angular movement of the containment arm (10) so as to maintain the containment roller (11) in a symmetrical position with respect to the tracer roller (14) across the vertical plane.

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"A ring rolling mill".

The present invention relates to ring rolling mills of the type comprising:

- a driven working roll with a fixed vertical axis,
- 5 - a table movable towards and away from the roll,
- a vertical-axis rotary mandrel carried by the table and serving as a counter-roll, about which the ring is disposed in such a way that it rests on the table and is rolled between the roll and the mandrel, the axes of the roll and of the mandrel lying in a vertical plane parallel to the direction of movement of the table,
- a containment roller having a vertical axis 15 and operable to laterally engage the ring during rolling,
- an arm pivotable about a vertical axis, which carries the said roller at a free end, and
- means for making the containment arm rotate 20 in such a sense as to displace the containment roller from the said vertical plane gradually as the diameter of the ring increases upon rolling.

In ring rolling mills of the type specified above there is a problem in maintaining the containment roller in engagement with the outer surface of the ring being worked.

In prior art ring rolling mills, the movement of the pivoted arm which carries the containment roller is controlled, by means of a kinematic mechanism including

a cam, by the rotation of the working roll. In this way, the displacement of the containment roller is controlled in dependence on the time elapsed from the beginning of the rolling operation. This is unsatisfactory inasmuch as the increase in diameter of the ring by the effects of the rolling does not follow an exact law and can vary within wide limits as a function of the conditions in which the rolling operation is performed, and as a function of the intrinsic characteristics of the material of the ring subject to rolling.

There can thus occur situations in which displacement of the containment roller with respect to the plane identified by the axes of rotation of the working roll and of the mandrel is insufficient, giving rise to conditions of juddering. In other cases the displacement of the containment roller is excessive: the ring is then free to pivot about the position defined by the nip between the working roll and the mandrel acting as counter-roll.

In both the above indicated situations the final product of the rolling operation is defective and must be scrapped.

The object of the present invention is to provide a ring rolling mill of the above identified type, which does not have the above indicated disadvantages.

With a view to achieving this object, the subject of the present invention is a ring rolling mill of the type specified above, characterized by the fact that it includes:

- a tracer arm pivoted about a vertical axis

which is a mirror image of the said containment arm across the said vertical plane and is resiliently biased towards this plane,

- a tracer roller having a vertical axis, carried by the said tracer arm and having the same diameter as the containment roller,
 - a pair of angle sensors, each sensitive to the angular position of a respective containment or tracer arm, and
- 10 - a control circuit supplied with signals produced by the angle sensors and operable to control the said means for making the containment arm turn in such a way as to maintain the containment roller in a symmetrical position with respect to the tracer roller
- 15 across the said vertical plane.

Owing to this characteristic, the containment roller is constantly maintained in lateral engagement with the ring being rolled, preventing the occurrence of the phenomena of juddering or of free oscillation

20 previously described.

The advantages deriving from the invention will become apparent from the following description, given with reference to the attached drawings provided by way of non limitative example, and in which:

- 25 - Figure 1 is a perspective view of the upper portion of the ring rolling mill according to the invention,
- Figure 2 is a plan view, partially sectioned, of the rolling mill,
- 30 - Figure 3 is a schematic representation of

the electrical and hydraulic control and regulation system of the rolling mill, and

- Figure 4 is a block diagram showing the inner structure of one of the elements of Figure 3.

5 In Figure 1, there is generally indicated a base 1 which carries at its upper end a working plane 2 on which the working roll 4 is rotatably mounted about a vertical axis 3. The working surface 2 includes a table 5 movable towards and away from the roll 4 along a 10 pair of guides 6. The table 5 carries a mandrel 7 freely rotatable about a vertical axis 8. The mandrel 7 serves as a counter-roll in the operation of rolling a ring A disposed about the mandrel 7 and resting on the table 5.

15 Normally, the lateral surface 4a of the working roll 4 and the lateral surface 7a of the mandrel 7 have profiles which are respectively complementary to the profiles of the outer and inner surfaces of the ring A.

Mounted about a vertical shaft 9 carried by the 20 support 1 there is a pivoted arm 10 which carries at its free end 10a a containment roller 11 operable to engage the ring laterally during rolling. The containment roller 11 acts on the semi-circle of the ring A which, with reference to the direction of rotation of 25 the ring A, is located in advance of the portion of the ring A lying between the roll 4 and the mandrel 7 during the rolling operation which is performed, in the case illustrated, by making the ring A turn in a clockwise sense.

30 In a mirror image position with respect to the

- 5 -

arm 10 and the containment roller 11, across the vertical plane identified by the axes of rotation 3 and 8, there is rotatably mounted, about a shaft 12 carried by the base 1, a second pivoted arm 13 which carries 5 at its free end 13a a roller 14 having the same diameter as the containment roller 11 and which serves as a mechanical tracer.

The pivoted arm 13, which carries the tracer roller 14, is resiliently biased in engagement with the 10 ring A being rolled by resilient means constituted by a helical spring 15 contained in a single-acting hydraulic cylinder 16 arranged below the working plane 2 and the piston rod of which is connected with the tracer arm 13 by means of a connecting rod 17.

15 The force exerted by the spring 15 can be opposed by the action of the hydraulic cylinder 16, which serves to make the arm 13 turn outwardly of the movable table 5 in such a way as to space the tracer roller 14 from the position of engagement with the ring A, for 20 example, to permit the insertion of the ring between the roll 4 and the mandrel 7 at the beginning of the rolling operation.

The turning of the containment arm 10 about the shaft 9 is controlled by a double-acting hydraulic actuator 18 arranged below the working plane 2, by means 25 of an arm 19 rigidly connected with the arm 10 for rotation about the shaft 9.

The rolling mill according to the invention further includes means (not illustrated) for control of 30 the movement in a horizontal sense of the movable table

5 towards and away from the roll 4. In the position of maximum spacing from the roll 4, the table 5 can be tipped up about a horizontal shaft 20 in such a way as to permit automatic discharge of a ring which has been
5 subjected to a rolling operation.

In axially aligned positions with respect to the shafts 9 and 12 there are mounted two angle sensors 21, 22 which are sensitive, respectively, to the angular position of the containment arm 10 and that of the
10 tracer arm 13. In the embodiment illustrated, each angle sensor 21, 22, which can be of the potentiometric type or of the type known in the relevant technical literature as an "angle encoder", comprises a rotary portion connected by means of a respective bracket 23, 24
15 to a flange 25, 26 rigidly connected with the respective arm 10, 13, and a stator portion connected by means of another bracket 27, 29 with the base 1 of the rolling mill.

Preferably, each of the flanges 25, 26 has arcuate slots 30, 31 traversed by the brackets 27 and 29.

The angle sensors 21, 22 may be provided with angle multipliers, for instance angle multipliers of the gear type.

The electrical signals produced by the angle sensors 21, 22 are supplied to a control circuit 32, having the inner structure shown in detail in Figure 4.

In Figure 4, 33 designates a comparator circuit controlling a solenoid valve 34 which acts on the hydraulic actuator 18 to control the movement of the containment arm 10.
30

As soon as the comparator 33 detects the existence of a difference between the position of the containment roller 11 with respect to the vertical plane identified by the axes of rotation 3 and 8 and the position, with respect to the same plane, of the tracer roller 14, the solenoid valve 34 is acted upon in such a way that the hydraulic actuator 18 re-establishes the conditions of mirror-symmetry of the containment roller 11 and the tracer roller 14 with respect to the said 10 plane.

Preferably, the comparator circuit 33 is of the threshold type with hysteresis for the purpose of preventing the occurrence of uncontrolled oscillation phenomena in the automatic circuit for regulation of the 15 position of the containment arm 10.

By 35 is designated an arithmetic circuit which is supplied with the signals produced by sensors 21, 22 and which produces at its output a signal corresponding to the average of the two input signals.

20 The average signal provides an indication of the diameter of the ring A being rolled.

It should be pointed out that each one of the signals produced by sensors 21, 22 provides an indication of such diameter, since this diameter is positively 25 identified by the angle formed by each one of the arms 10, 13 with respect to the vertical plane identified by the axes of rotation 3 and 8.

The averaging operation allows however a more precise signal to be obtained which is not influenced 30 by slight dissymmetries which may instantaneously re-

sult in the positioning of ring A with respect to the said plane.

The signal produced by circuit 35 is supplied to a threshold circuit 36, where this signal is compared 5 with a signal level corresponding to a diameter value which was previously selected by acting on a potentiometric selector, such as a digital switch 37.

In addition to the solenoid valve 34, the threshold circuit 36 controls a second solenoid valve 38 10 which acts on the hydraulic cylinder 16 and controls the outward movement of the tracer arm 13.

When the average value of the signals produced by the angle sensors 21, 22 reaches the reference level set in selector 37, the threshold circuit 36 acts on 15 the solenoid valves 34, 38 to cause outward turning of the arms 10, 13 to space the containment roller 11 and the tracer roller 14 from the engagement position with ring A.

At this point the rolling process is terminated 20 and ring A can be removed from table 5.

CLAIMS:

1. A ring rolling mill of the type comprising:
 - a driven working roll with a fixed vertical axis,
 - a table movable towards and away from the 5 roll,
 - a rotatable mandrel with a vertical axis carried by the table and serving as a counter-roll, and about which the ring is arranged in such a way that it rests on the table and is rolled between the roll and 10 the mandrel, the axes of the roll and the mandrel lying in a vertical plane parallel to the direction of movement of the table,
 - a containment roller with a vertical axis, operable to laterally engage the ring being rolled,
- 15 - an arm pivoted about a vertical axis, which carries the said roller at a free end, and
 - means for making the containment arm turn in the sense such as to displace the containment roller from the said vertical plane gradually as the diameter 20 of the ring increases by the effect of rolling,
- characterised by the fact that it comprises:
 - a tracer arm (13) pivoted about a vertical axis and which is a mirror image of the said containment arm (10) across the vertical plane and is resiliently biased towards this plane,
 - a tracer roller (14) with a vertical axis, carried by the said tracer arm (13) and having the same diameter as the containment roller (11),
 - a pair of angle sensors (21,22) each sensi-

tive to the angular position, respectively, of the containment arm (10) and tracer arm (13) and

- a control circuit (32) supplied with the signals produced by the angle sensors (21,22) and opera-

5. ble to control the said means (34,18) for making the containment arm (10) turn in such a way as to maintain the containment roller (11) in a symmetrical position with respect to the tracer roller (14) across the said vertical plane.

10 2. A ring rolling mill according to Claim 1, characterised by the fact that the said means for making the containment arm (10) turn comprise a double-acting hydraulic actuator (18) for control of the turning of the arm itself, and a servo valve (34) for commutation, regulation and locking of the movement of the actuator (18).

15 3. A ring rolling mill according to Claim 1 or Claim 2, characterised by the fact that it includes a hydraulic cylinder (16) operable to make the tracer arm (13) turn outwardly of the movable table (5) to space the tracer roller (14) from the engagement position with ring (A).

20 4. A ring rolling mill according to Claim 1, characterised by the fact that the angle sensors (21,22) are of an electro-mechanical type.

25 5. A ring rolling mill according to Claim 4, characterised by the fact that the angle sensors (21,22) are of a potentiometric type, are disposed in positions respectively aligned with the pivotal axes of the containment arm (10) and the tracer arm (13), and each in-

clude a rotor portion connected by means of a respective bracket (23,24) to a flange (25,26) rigidly connected with an associated arm (10,13) and a stator portion connected by means of another bracket (27,29) to
5 the base (1).

6. A ring rolling mill according to Claim 4 or Claim
5 characterised in that the angle sensors (21,22) are
provided with angle multipliers of the gear type.

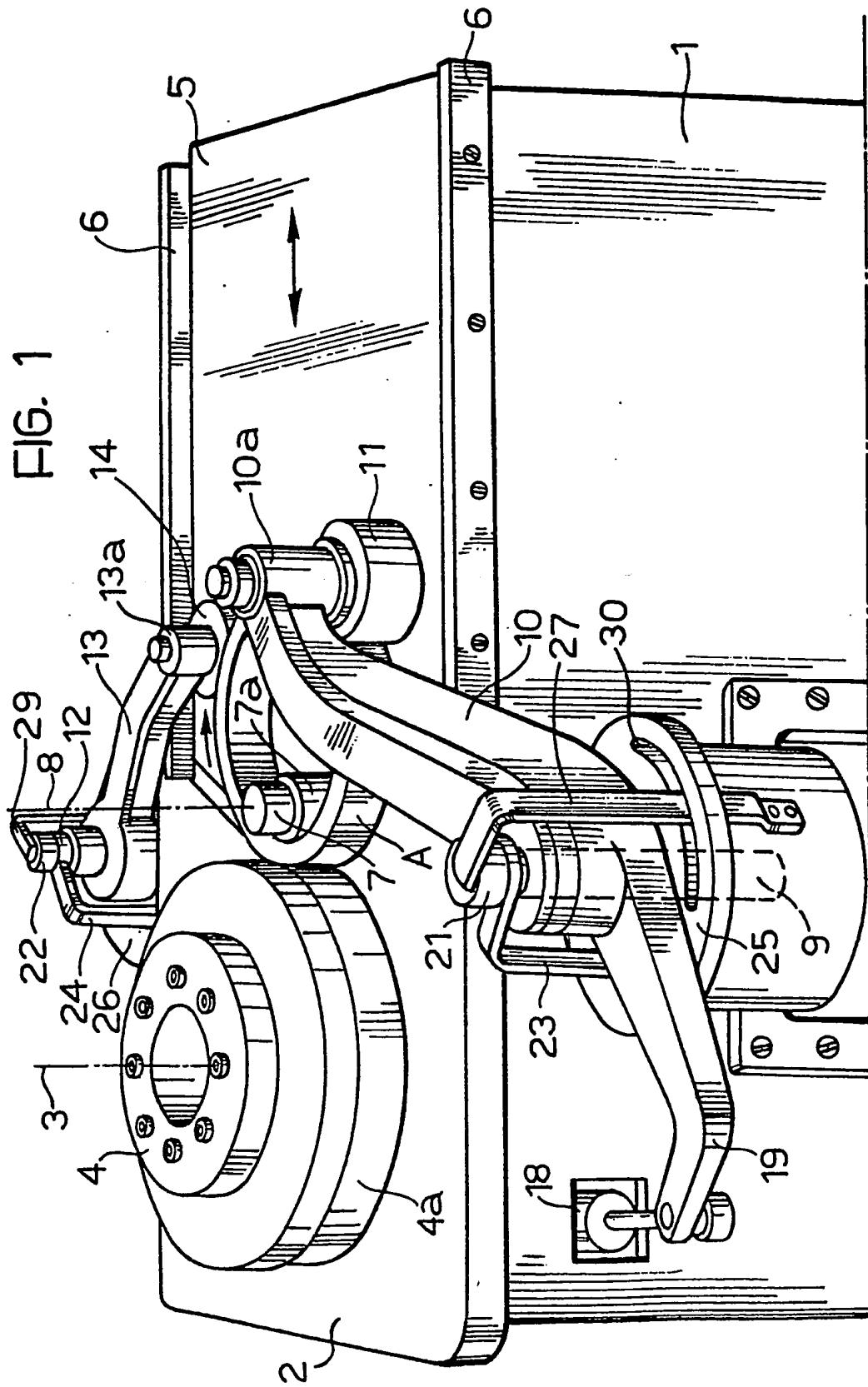
7. A ring rolling mill according to Claim 1, charac-
10 terised by the fact that the control circuit includes
a comparator circuit of the threshold type with hyste-
resis (33).

8. A ring rolling mill according to Claim 3, charac-
15 terised by the fact that it includes an arithmetic cir-
cuit (35) to produce a signal corresponding to the ave-
rage value of the signals produced by the angle sensors
(21,22) and a threshold circuit (36) to compare said
signal corresponding to the average value with a refer-
ence level and by the fact that said threshold circuit
20 (36) acts on said hydraulic actuator (18) and on said
hydraulic cylinder (16) for disengaging the containment
arm (10) and the tracer arm (13) from the engagement
position with the ring (A) when the average value of
the signals produced by the angle sensors (21,22) rea-
25 ches said reference level.

9. A ring rolling mill according to Claim 8, charac-
terised by the fact that it includes means (37) for se-
lectively setting said reference level in the threshold
circuit (36).

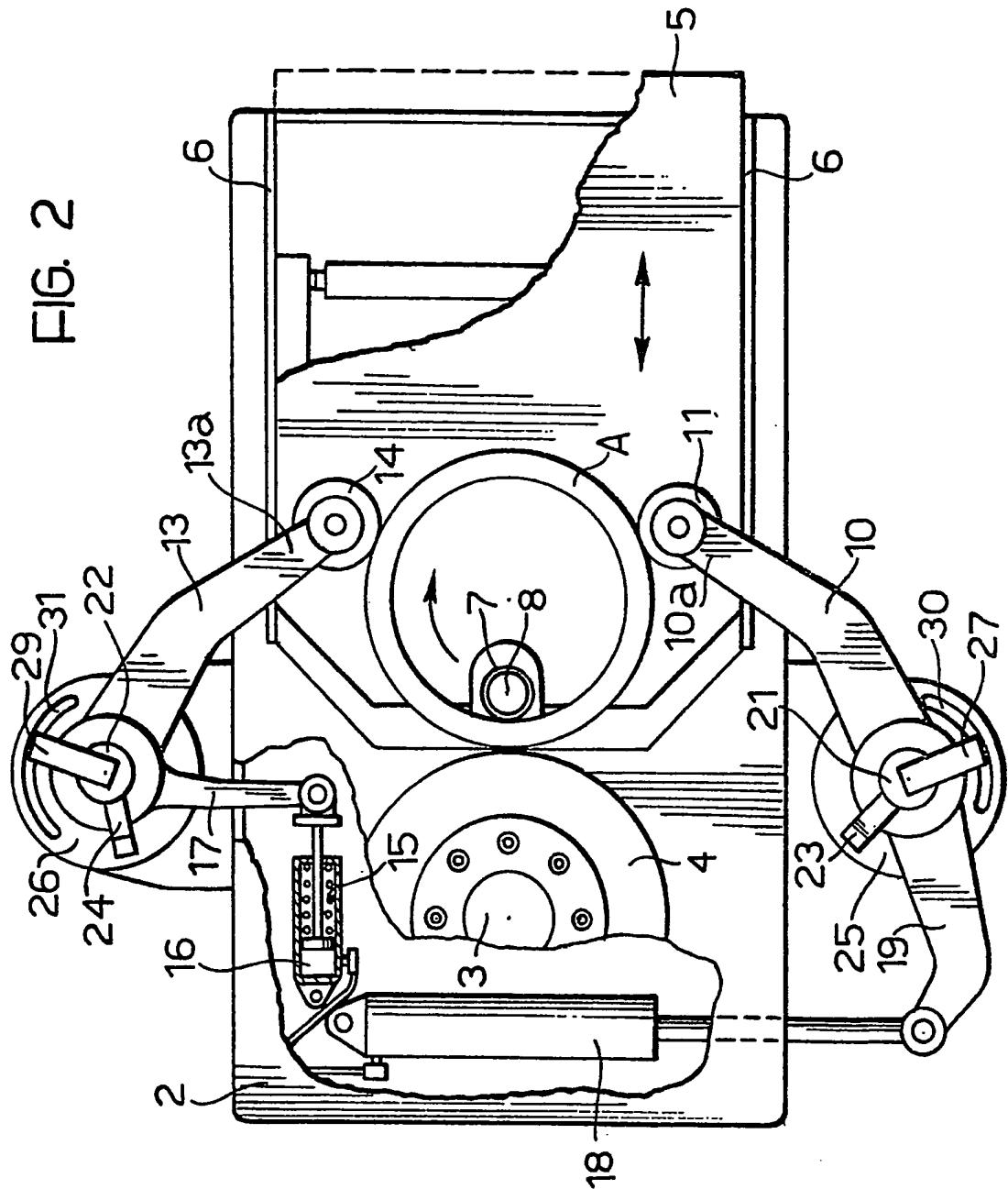
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FIG. 1



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FIG. 2



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FIG. 3

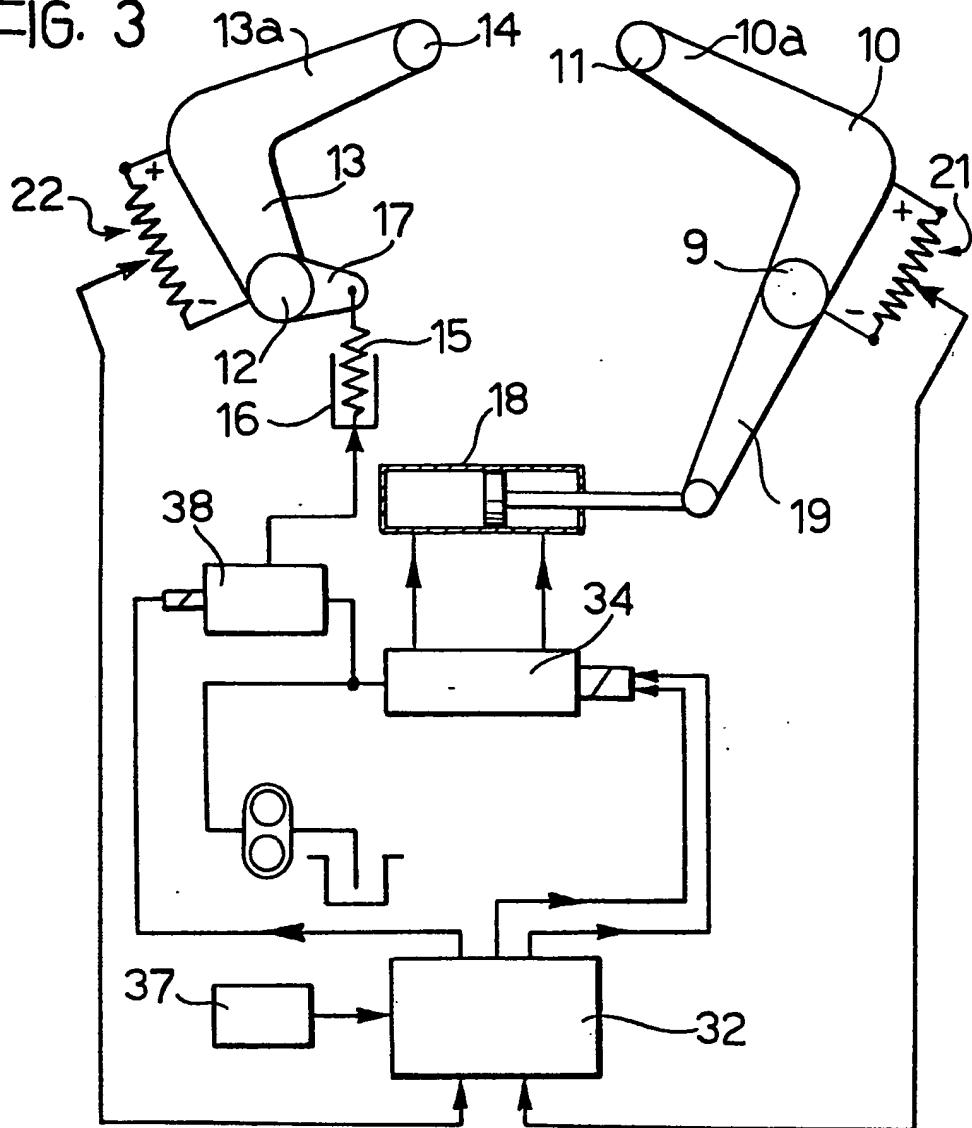
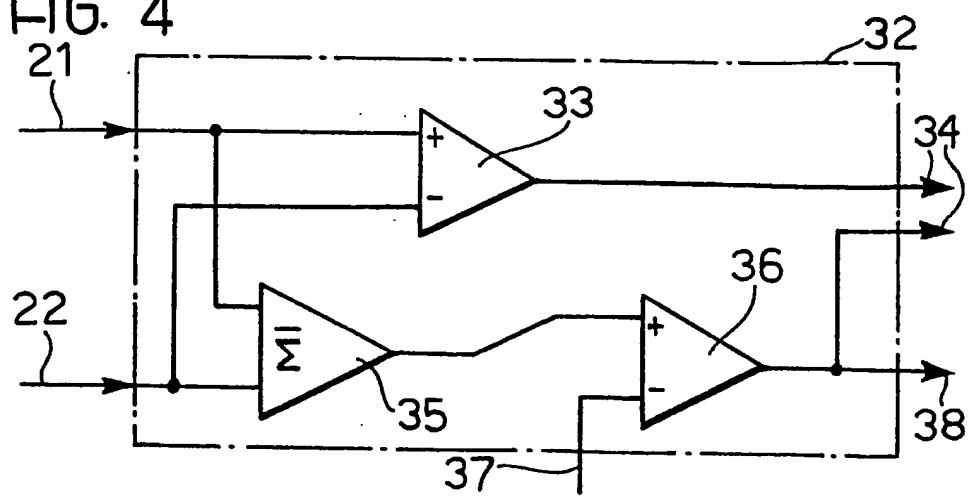


FIG. 4





European Patent
Office

EUROPEAN SEARCH REPORT

0063103

Application number

EP 82 83 0072

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
X	FR-A-2 183 987 (RHEINSTAHL) *Page 10; line 8 to the end; figure 4* & US - A - 3 824 820	1-4, 5, 8	B 21 H 1/06
A	DE-B-1 188 544 (ULRYCH) -----	1	
TECHNICAL FIELDS SEARCHED (Int. Cl. 3)			
B 21 H			
The present search report has been drawn up for all claims			
Place of search THE HAGUE	Date of completion of the search 23-07-1982	Examiner SEMBRITZKI K.G.	
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